CELESTIAL STUDIES

STARS BROUGHT TO EARTH.

All Light Science Can Direct on the

(Correspondence of the Dispatch.)

LONDON, November 4 .- A new pathway to knowledge concerning the celes-

tial bodies has been opened by the es-

of the workship of astronomical physicsthat astronomy which deals with the constitution and condition of heavenly

the elements of which stars millions of

the nature of the solar atmosphere in a

tle corner of this insignificant earth

The years that followed the application

were crowded with a succession of brilliant discoveries in the same field. Kirchhoff, Bunsen, Angstrom, Thalen, added elements after elements to the list of those recognized in the sun. Huggins

and Miller carried the same research into a far more difficult field, and showed

us the same elements in the stars. Ruth-

erford and Secchi grouped the stars ac-cording to the types of their spectra, and so laid the foundations of what may be termed stellar comparative anatomy.

Huggins discovered true gaseous nebulae, and so revived the nebular theory, which

had been supposed crushed when the great telescope of Lord Rosse appeared to have resolved several portions of the

Orion nebula into separate stars.

The great riddle of "new stars"—which

nethed was discovered of observing commences without an eclipse, and were found to wax and want with

still remains a riddle-was at last at

PUZZLES

Distinctly Seen.

MADE



to it fresh and valuable, and often un-In this activity, Greenwich Observatory practically took no part, until in Sir William Hugʻins's skilful hands the spectroscope showed itself not only as a means for determining the condition and constitution of the stars, but also their means for the stars but also their means for the stars.

stitution of the stars, but also their ovements. The principle of this inquiry is as follows: If a source of light is approaching us very rapidly, then the waves of light coming from it necessarily appear a little shorter than they really are, or, in other words, that light appears to be slightly more blue—the blue waves being shorter han the red—than it really is. A similar hing with regard to the waves of sound

often noticed in connection with a lway train. If an express train, the whistle of which is blowing the whole time, dashes past us at full speed, there is a perceptible drop in the note of the whistle after it has gone by. The sound waves as it was coming, were a little shortened, and the whistle, therefore, ap-peared to have a sharper rote than it had THE SUN, THE MOON, AND THE shortened, and the whistle, therefore, appeared to have a sharper note than it had in reality. And in the same way, when it had gone by, the sound waves were a little lengthened, making the note of the whistle appear a very little flatter.

Such a change of color in a star could never have been detected without the spectroscope; but since when light passe through a prism the shorter waves at refracted more strongly—that is to same more turned out of their course that the longer—the spectroscope affords up

Subject Used-Photographs of the the longer—the spectroscope affords the means of detecting and measuring Moon-The Lunar Craters Can Be this change. Let us suppose that the lines of hydrogen are recognized in a given star. If we compare the spectrum of this star with the spectrum of a tube containing hydrogen and through which the electric spark is passing, we shall be able to see whether any particular hyable to see whether any particular hydrogen line occupies the same place as shown by the two spectra. If the line from the star is a little to the red of the line from the tube, the star must be receding from us; if to the blue, approaching us. The amount of displacement may be measured by a delicate micrometer and the rate of motion contablishment at Greenwich. Observatory bodies, not with their movements. It is difficult to imagine a more interesting crometer and the rate of motion con-

study than that which goes on in this The principle is clear enough. The acunique workshop. Think of investigating tual working out of the observation was one of very great difficulty. The move-ments of the stars towards us, or away miles away are composed, and deciding from us, are, in general, extremely slow as compared with the speed of light itself, and hence the apparent shift in position of a line is only perceptible when a very powerful spectroscope is used. This means that the feeble light of the spectroscope to the study of the sun, and the demonstration that sedium and from existed in the solar atmosphere, of a star has to be spread out into a great length of spectrum, and a very powerful telescope is necessary. The work of observing the motions of stars in the line of sight was started at Green-

devote the great 28-inch telescope chiefly double-star work, and to transfer the

graphic reflector, but this is not its chief graphic reflector, but this is not its chief purpose. Its principal floor will contain four fine rooms, which will be used as composing-rooms—for the office work, that is to say, of the observatory. Of these the principal is in the north wing, where the main entrance is placed, and is occupied by the astronomer royal and the office work. The prominence work had also to be dropped, partly for the same reason, but their greatest development.

The prominence work had also to be dropped, partly for the same reason, but their appearance from time to time, and especially when sunspots were increasing in number, or were at their appearance from time to time, and especially when sunspots were increasing in number, or were at their appearance from time to time, and especially when sunspots were increasing in number, or were at their appearance from time to time, and especially when sunspots were increasing in number, or were at their greatest development.

The prominence work had also to be dropped, partly for the same reason, but office work. two chief assistants. The upper floor will eventually be used for the will eventually be used for the storage of photographs and manuscripts, and the terrace roofs of the four wings will be exceedingly convenient for occa-sional observations, as, for example, of meteor showers. The central dome. sional observations, as, to meteor showers. The central dome, which rises high above the level of the terraces, is the only room in the building devoted to telescopic work. Like the new Altazimuth building, a ring of circu-

new Altazimuth building, a ring of circular lights just below the coping of the wall recalls the portholes of a ship, and again reminds us of the connection of the observatory with navigation.

Here the spectroscope is now placed, but not, as it happens, on the Thompson refractor. The equatorial mounting in his new dome is a modification of what usually called the "German" form of

ounting—that is to say, there is but one or to support the telescope, and the lescope rides on one side and a counteroise balances it on the other. The Great Equatorial," on the other hand, an example of the English mounting. With this attempt to determine the mo ected on the sky, but as they approach is or retreat from us, the story of the egular—the routine—work of the obserregular—the Foldine—work of the coses-vatory comes to an end. But, possess-ing the telescopes, and possessing the trained observers, it has been inevitable that there should have occasionally have been some stepping outside the rigid pro-gramme. So a number of beautiful drawings of the moon and planets were made by Mr. James Carpenter, and the writer was enabled to make a pretty complete study of the planet Mars in the Opposi-tion of 1877, and to secure occasional drawings of it in later years. Eighteen seventy-seven was famous as the year when Schiaparelli made his great discovery of the "canals," but he did not notice them until after the close of the Green-wich observations. Several of them were however, distinctly seen in Greenwich in the two following oppositions of Mars in 1879 and 1881-'2; but they seemed to the observer not hard, sharply defined chan nels on the surface of the planet, bu somewhat diffused and shaded lines, and

mistakable answer. The great spot of November, 1892, which was connected with so remarkable an aurora and so violent a magnetic storm, was as singular in its spectrum as in its earthly effects. The sun was only seen through much fog, and the spectrum was, therefore, very faint, but shooting up from almost every part of its area, except the very darkest. almost every part of its area, except the very darkest, were great masses of intensely brilliant hydrogen, evidently under great pressure. The sodium lines were extremely broadened, and on November 20th a broad, bright flame of hydrogen was seen shooting up at an immense speed from one edge of the nucleus. A similar effect—an outburst of intensely luminous hydrogen—has often been observed in spots which have been accompanied by great magnetic storms, and it may even be that it is this violent eruption of intensely heated gas which has the directest connection gas which has the directest connection with the magnetic and auroral disturb-

This sunspot work was not carried on for very long, as only one assistant could be spared for the entire solar work of whatever character. Yet in that time an whatever character. Yet in that time an interesting discovery was made by the writer-namely, that in the green part of the spectrum of certain spots a number of broad diffused lines or narrow bands made their appearance from time to time, and especially when sunspots were increasing in number, or were at

tions at Greenwich are not suitable for these delicate astrophysical researches. When the observatory was founded "in the golden days" of Charles II., Greenwich was a little country town far en removed from the great capital, and re-interference from its smoke and dus had to be feared, or was dreamed of Now the "great wen," as Corbett called it, has spread far around and beyond it and the days when the sky is sufficiently pure round the sun for successful spectrum work on the spots or prominence are few indeed.

Whether in the future it will be thought Whether in the future it will be thought advisable for the Royal Observatory to enter into serious competition in inquiries of this description with the great "astrophysical" observatories of the Continent and of your United States—Potsdam, Meuden, the Lick, and the Yerkes—I cannot say. That would involve a very considerable departure from its original programme, and probably also a departure from its original site. For the conditions at Greenwich tend to become steadily less favorable for such work, and it liy less favorable for such work, and it would most probably be found that full efficiency could only be secured by setting up a branch or branches far from the monster town.

It is interesting to note that a marvel-It is interesting to note that a marvel-lous collection of photographs of the moon is being made at the Paris Observatory. When completed this will provide astro-nomers with a permanent and trustworthy record of the principal features observa-ble on the surface of our satellite. The ble on the surface of our satellite. The latest addition to this photographic lunar album is published in the annual report fust finished by the director of the observatory, M. Loewy, and is here reproduced. It is not too much to say that this is the finest photograph of the crescent moon that has yet been taken. The moon was only four days six hours cld, and therefore not far from the sun at times. At such a time considerable diffisunset. At such a time considerable difficulty is experienced in photographing the moon, for an exposure can only be com-menced at the end of twilight, and our above the horizon.

en no occasion has the mysterious phenomenon of "gemination," or doubling of the canals, been observed at Green-

GIRLS PLAYING GOLF.

DIFFERENCE BETWEEN GRACEFUL AND UNGAINLY POSES.

DON'T STUDY STRIKING ATTITUDES.

Try to Forget Yourself in Your Interest for the Game and Grace Will Come Naturally-Other Sug-

(Correspondence of the Disputch.) NEW YORK, October 22.-It is a delicate matter to lay down the law to a member of the fair sex as to how she should stand when playing golf, how she should swing her arms, and what attitude would be the means of giving to her motions on, adding to its velocity until it comes of the finest abode that money can an ease and grace that will make her in contact with the ball. The result in chase and architectural skill design

"At the top of the swing my ciub is as hearly horizontal as possible. I grasp as firmly as possible with both hands throughout the swing for every shot. I armly as possible with both hand throughout the swing for every shot. am aware that the general belief is contrary to this, especially in the driving but the fact remains that I find it very satisfactory, and there are many good players who, I know, are with me on this point. If the right hand be held loosely for the previous part of the swins. for the previous part of the swing surely must have a firm grip of the cle

when it strikes the ball.
"In gripping my club the left hand is partly hidden, the first finger and thumb being firmly locked in the right hand. The thumb of the left hand is kept along the shaft, not around it, and the little finger of the right hand rides the fore-singer of the left. In this matter, so far as I know, I stand alone, nor do I venture to advise beginners, or, in fact, any

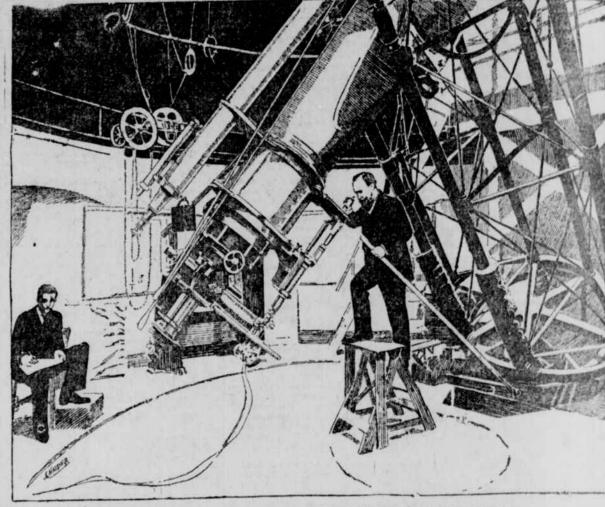
one else to copy it. "As to pressure being put in the down stroke, pressure should be used through-out. I fall to see how one could come gently to within one foot and a half of the ball and at the last moment put in the necessary strength. Immediately at the de-scent of the club pressure should be put MONSTER TELESCOPE

YERKES INSTRUMENT. RESTS OR RUNS ON A STEEL TRACK

DESCRIPTION OF THE CREAT

The New Observatory Building at Lake Geneva is Almost as Interest. ing as the Famous Mechanism for

(For the Disputch.) LAKE GENEVA., WIS., September 2 -It must be admitted that the future home of such a world-renowned instrument as the great Yerkes telescope is deserving of the finest abode that money can pur



SUN, MOON, AND STARS BROUGHT TO EARTH!

the admired of all admirers on the golf | this case should neither be so strained | this and more can be justly claimed for satellite is then at but a small elevation course, and what antics will cause her to be considered awkward and stiff. To begin with, it is best to tell the athletic girl who aspires to be a golf player to be natural. Do not seek to add to the grace of your carriage on the golf field by standing with every muscle tense and every nerve keyed up to the highest pitch in the effort to avoid being ungainly. Forget yourself and study only the ball. In so studying you will find that the gracefulness that is inseparable from a forgetfulness of self is yours, After learning to play the game with-

as if it were made just when the club is of construction at this place. The ball-nearing the ball."

a correct style naturally, by all means get a teacher, and let him or her try to drill you into it. Better far, though, if you drop into the habit of playing with grace and ease without studied effort.

PAPER COLLARS.

They Are Still Made, Largely for Export.

(New Orleans Times-Democrat.) 'Oh, yes, paper collars are still made,' said a haberdasher, smilingly, in reply to an inquisitive customer. "Thirty years ago they were worn by men who considered themselves very good dressers. their use is confined to a few old fellows | der the main dome. who won't change, and, of course, they have to be manufactured to order. There are several customers for them here, and a wealthy planters who lives some distance north of the city orders them by thousand lots. I was in New England last summer, and while visiting a little town famous for its collar-makers saw an old plant used for turning out the paper article. It had been rusting away in silence for years, and I was astonished at its size. The buildings easily covered an acre, and the machinery was enormous. I was told that in its heyday the concern shipped its product all over the world, and sold paper collars even in the Fiji Islands. I supposed they must have been used as trimmings for missionary ragout. are several customers for them here, and

been used as trimmings for missionary ragout.

"The celluloid collar industry is still very much alive, and you may be surprised to know that its trade last year was the largest on record. Who buys them? Lots of different people. Thousands are sold to seafaring men, particularly those whose voyaging takes them into the tropics. France, Germany, and Italy import an immense aumber. Another big lot is supplied under contract to the Russian army—a fact not generally known—and I understand there is a large sale of them in Turkey.

"The principal market in this country is in the West. The lumbermen up in the Minnesota and Wisconsin regions regard them as very recherche, and they are worn generally by policemen, who would find it impossible to keep a linen collar looking neat in bad weather. The great objection to ceiluloid collars used to be their inflammability. Their composition is very like gun-cotton, and it was formerly a common joke to touch a match to a fellows neck-gear and see it vanish. You can't do that now. A new process has rendered them fireproof."

Skeletons of Ancient Libyans.

(London Mail.)
During his comprehensive explorations in Egypt, Professor Flinders Petric came upon an ancient cemetery of very large proportions, from which he unearthed a

great number of skeletons belonging to a people which have since been termed "the new race." people which have since been termed "the new race."

A representative collection of these skeletons, carefully numbered, has now arrived at the Cambridge University, from the spot near Thebes where they were found. Material was thus furnished for a study of variation in the human skeleton, and the series of minute measurements which have been made not only furnish valuable statistics, but bring out several interesting features with reout several interesting features with re gard to the original owners of the bones

out several interesting features with regard to the original owners of the bones. The ancient people, according to the discoverer of their remains, constituted a "branch of the same Libyan race that formed the Ammonite power," and their date is put down by him as between 4000 and 2000 B. C.

The dimensions of the long bones point to a stature similar to that of the French; but while in France the women vary most, the opposite held good with "the new race." Taking everything into consideration, support is given by the investigation to a generalization in Professor Pearson's forthcoming book on the "Chanas of Deait," that "the more primitive and savage a race, the less will be the variation of both saves, and the greater will be the approach to equality of variation between them."

That the early inhabitants of the country round Thebes followed the primitive custom of "squatting" is shown by the structure of the bones of the foot, which manifests the peculiarities found in modern tribes adopting that practice.

A simian character-viz. the sacral notch in the base of the vertebral column—was looked for, and might have been expected in auch an early rate. It was, however, looked for in vain. In fact, in many characteristics, the skeletons are most modern, while in others they are the reverse.

The men and women to whom they belonged may be summed up as a hardy, vigorous people, in the proportion of their limbs approaching to the negroes, while the spine and shoulder blades show a more determinable affinity to Europeans.

nor likely to render the aim ineffective, the Yerkes Observatory, now in prace Taylor, as will be seen, gives some sound advice. No good golf player ever plays awkwardly. If you cannot acquire votees of science. It is a picture of the debuilding outwardly, and the design is unique one. The observatory is so form ed as to take the shape of a Latin cross the extramities comprising three to or domes. The length of the building is 326 feet, and the main dome, under which the great telescope will report, is \$0 feet in diameter.

A MONSTER TELESCOPE.

It is in and around this main done the chief interest centres. these do not begin to compare in

One remarkable thing about this main dome is that it revolves was the ingenitect surmounted the sary to give the telescope sweeping the skies. Like the warship, the dome from warship, the great Yerkes ins be moved at the will of an that it points in any direction The device for swinging the is a very simple and convenient one. The track is a rall resting on a cast-ire girder boited to the masonry. The what by which the dome revolves on are 36 in number, and the journals fitted with roller bearings, and are constructed that the wheels selves to any chance ined ralities in the

smoothness of the track. HOW THEY WORK. Without going into the technical details that are so tiresome to the lay reader this is the way the dome and he great telescope are made to revolve: By mess of an apparatus located in the lower par of the building, the dome can be melther by hand or power machinery. an endless cable wound around the and connecting with this machi-causes the dome to revolve on its t

By starting this cable in motion the is moved in either direction The amount of work and care involved illustration of the building of the big dome. It was need ercise the greatest care less of the atmospheric disturba mon to this part of the aster should occur before parts of the dome were soll

GREAT ANXIETY Besides the difficulty of this revolving dome, piece by was the delicate work of telescope and the machine it is operated. All this wa and methodically, and with of any king. The likelihood dent was so great, however in charge of the work have perfect fever of anxiety sin and only now that the worst they beginning to breathe fr

WELL ILLUMINAT Of the monster that is higreat dome, Professor Good director of the Yerkes Obser "In addition to the ordinar for actuating the quick and and clamping the telescope, system of electric motions, filumination is provided. of placed switches at the eye of equatorial head enable the stop the slow-motion motor clamp or unclamp in right as declination by simply pres-

The quick-motion motors at from the balcony by switch the eye end by cords. The illuminated by incandescent nected with switches at the coon the bead. Provision is also electric illumination of the t wires. "The forty-inch objective of the

telescope was made at Camil Mass., from disks furnished by of Paris. The crown lens is and a half inches thick at the three quarters of an inch at the rds weighs 200 pounds. The leaves weighs 200 pounds. The leaves mounted upon aluminum bearings in iron cell.

An Important Difference.

To make it apparent to thousands, think themselves ill, that they are not a mix themselves in, that they are mixed with any disease, but the system simply needs cleansing, is to comfort home to their hearts, as a condition is easily cured by using of Figs. Manufactured by the Calif Fig Syrup Company only, and sold by all druggista.

LATEST PHOTOGRAPH OF THE MOON.



telescope, of 123-4 inches aperture, was not powerful enough to do much more than afford a general indication of the direction in which the principal stars were moving, and to confirm in a general way the inference which various astronomers had found, from discussing the proper motions of stars, that the sun and the solar system were and the solar system were moving towards that part of the heavens where the constellations Hercules and Lyra are placed. In 1890, therefore, the work was discontinued, and the 123-4 telescope, by Merr was a small the 123-4 telescope, by Merz, was removed to make room for the present much larger in-strument, by Sir Howard Grubb, upon the same mounting. The new telescope being much larger than the one for which mounting and observing room were origi-nally built, it was not possible to put the spectroscope in the usual position, in the same straight line as the great spec-troscope. It was, therefore, mounted under it, and parallel to it, and the light of the star was brought into it after two reflections. The observer, therefore, stood with his back to the object, and ocked down into the spectroscope. locked down into the spectroscope. It had, however, become apparent by this time that this most delicate field of work was one for which photography possessed several advantages, and as Sir Henry tomets, merewire studied and all yielded and all yielded graphic equatorial, it was resolved to more or less sympathy with the solar pots. Sunspots, planets, comets, meta-prs, variable stars, all were studied

of the Greenwich routine. These were the daily mapping of the prominences round the sun and the detailed examinaround the sun and the detailed examina-tion of the spectra of sunspots. Both are almost necessary complements of the work done in the heliographic depart-ment—that is to say, the work of photographing the appearance of the sun day by day, and of measuring the positions and areas of the spots. For the spots afford but one index out of several of the changes in the sun's activity. The prominences afford another, nor can we at the present moment say authoritative ly which is the more significant. again, with regard to the spots them-solves, it is not certain that either their extent or their changes of appearance are the features which it is most important for us to study. We want, is possible, to get down to the soul of the spot, to find out what makes one spot differ from another, and here the spec-troscope can help us. Great sun-spots are often connected with violent agitation of the magnetic needles, and with displays of aurorae. But they are not always so, and the inquiry, "What makes them differ?" has been made again and again, without as yet receiving any un

number of delicate markings has been de number of delicate markings has been de-cided by this and previous photographs taken in Paris. Evidence is now forth-coming that, as in the case of our earth, the crust of the moon has been sculp-tured and modified both by the action of water and ice. Astronomers will await with the greatest interest the publication of the further information which M. E. WALTER MAUNDER, F. R. A. S. Alas for Greek Bachelors! (Pall-Mall Gazette.) According to a note in the Courrier de Paris, the Athenians and Greeks, collect-ively, intend to exclude all bachelors from

Parliament. The idea seems to be that the bachelor has no stake in Commonwealth; if he is represented, that is as much as he can ask for; a representative he ought never to be, for whom does he represent except himself? And herein the Greeks seem to fancy that they have found a cure for celibacy, so that all citizens will marry, and the lawful and legitimate population of Athens will increase, while every young Greek having pefore him as the summum bonum a seat in the Chamber will know that his best ssurance thereof will be the votes of his onstituents, based on the size of his family. Should the measure be passed-and there are so many canards of anti-bachelor crusades that one feels some doubt about the story—Europe will watch the experiment of the Parliament of the married men with much interest. It will not last long, because when women are elected to Parliament they will restore the bachelor legislator, as the sittings would be too duil for them without him. But it is a retrograde measure in any case. A Vienna savant has lately anunced that "love itself is probably a microbe." The microbe, we know always slays the unfittest; therefore, the married men are the unfittest; the bachelor is the fittest for a seat in Parliament.

(London Chronicle.)
"The tallest man in his army," who accompanied the German Emperor in his in his stockings. This Frederick-William mania of the Kaiser's is an old device of his for impressing the foreigner. On returning from his first visit to Constantinople in 1889, the Emperor sent the Sultan nople in 1889, the Emperor sent the Sultan having my right foot to the rear I keep it some three or four inches in advance. This I think to be best, for it allows the test to follow much more freely after the

ing it, it will be time to cultivate arts and graces. If you must model your style on that of another, be sure you copy one who knows the correct way to play golf gracefully, and do not let the blind lead the blind, for of all games golf is one in which care is necessary to

avold falling into the ditch. Here is the advice of the famous golf player and ex-Golf-Champion Taylor on the best way to cultivate style in playing the game: "Many things on which we the game: Many things on which we differ are of little or no importance, and the various opinions can be experimented on by the tyro without running the risk of incurring much hurt, but there are other things about which it will be wise to find out more from experienced players the reasons for and against, and then make a choice of what appears to be the best, and persevere in thinking it so, despite conflicting opinions. While there is no reason why any one should not become a good player who follows out the advice given by 'Badminton,' there are reasons why they cannot follow that advice, though they may try very hard to do so. The great drawback to those who would learn to play golf without having a professional adviser at their side is that they cannot see themselves as others see them. Could they do so, they would soon become aware of how poorly they are reproducing the swing of which they have read and how certainly which they have read, and how certainly they are contracting habits which can-not fail to be detrimental to their pro-

"I think, therefore, that every one who Emperor William's Tallest Soldier. is ambitious of becoming a golfer will do (London Chronicle.) well at the outset to seek professional tuition. A few lessons then would proba-bly be more useful than a great many visit to the East, is a grenadier named after the faults referred to have been ac-chlemke, who is nearly 6 feet 10 inches quired. My manner of playing is differ-in his stockings. This Frederick-William ent from either that of Dunn or 'Bad-

a complete set of kettle-drums, which he entrusted to the tallest officer in his army. Lieutenant Pleskow, who is very little, if at all, under 7 feet. Once, indeed, when this Prussian guardsman looked over a 7-foot garden well and asked a girl picking gooseberries therein what was the way to so-and-so, the simple maiden told him to ride first to the right and then to the left, and he would find the place he wanted. The nymph had honestly fancied that an officer overpeering her garden wall like that must necessarily be on horseback.

Old Papers for Sale

At the Dispatch office. 15a per bundred.

It some three or four inches in advance. This I think to be best, for it allows the body to follow much more freely after the swing in the direction of the intended fight of the ball. The weight of the body to follow much more freely after the swing in the direction of the intended fight of the ball. The weight of the body to follow much more freely after the swing in the direction of the intended fight such an early rate. It was, however, looked for, and might have been expected in such an early rate. It was, however, looked for in vain. In fact, in many characteristics, the skele-fight of the body is until the ball is being struck. By this means the body remains comparatively still during the backward swing, thus adding impetus to the flight of the body be thrown mostly on the left leg when addressing the ball, during the backward swing it has to be transferred to the right and back again with the downward stroke, thereby making, as it seems to me, the aim less steady.

The One indeed, when the direction of the ball is being struck. By this means the body remains comparatively still during the backward swing it has to be transferred to the right and back again with the downward swing it has to be transferred to the right and back again with the downward stroke, thereby making, as it seems to me, the aim left leg when addressing the ball, during the backward swing it has to be transferred to the right and back again wi

THE WORKSHOP!